

Easter does not fall on April 25, as given by the formula, but on April 18.

These exceptions are caused by an inconsistency in the Gregorian rule, caused by the adherence to the old custom, that Easter should never fall later than April 25.

Armagh Observatory, June 22. J. L. E. DREYER.

THE discrepancy between the date of Easter, 1954, April 18 as given by the tables in the Book of Common Prayer, and April 25 as given by the formula of Gauss, arises from a purely artificial contrivance of Clavius, who arranged the reformed calendar, which is thus described on p. 55 of "The Prayer Book Interleaved," 1873, in an account of the calendar founded on a paper by Prof. De Morgan:—"It will never happen as to mean lunations, and rarely as to real ones, that in the same cycle there should be the lunation of a given month beginning on the same day in two different years of the cycle; and such a thing never happened in the unreformed Calendar. Clavius thought it desirable to imitate this in the new Calendar; and he observed that by taking the preceding day whenever the Epact was xxv., and the year of the cycle after the 11th, he could avoid the reiteration, and thus make the desired resemblance." "Whenever the Epact should be xxv., the year of the cycle being upwards of 11, say that the Epact is 26. This is not an astronomical correction, but a mere conventional mode of reconciling the choice which Clavius made of the mode of writing the Epacts with an essential peculiarity of the old cycle of 19 years which that mode of writing would have otherwise destroyed." "In 1954 the Golden Number is 17, the Sunday letter C, and the Epact according to the ordinary rule, xxv. Call it therefore xxvi. Thence April 17 will be the 14th day of the Paschal Moon, April 18, Easter Day. If the Epact xxv. were used April 25 would be Easter Day." The paper by Prof. De Morgan will be found in the "Companion to the British Almanac" for 1845.

My copy of NATURE for April 5 has long since gone to Bolivia, but probably your correspondents will find that Gauss did not take into account this artifice of Clavius. If in this century golden number 6 and Sunday letter C had coincided, Easter would have been set on April 25, because 6 comes in the cycle before 11 instead of after it as 17 does. An inspection of Table III. for finding Easter will show in the two half-lines for April 17 and 18 the arrangement made by Clavius.

C. S. TAYLOR.
Banwell Vicarage, June 22.

Musical Thunder.

EARLY this morning a storm broke in this neighbourhood accompanied by heavy thunder. During the storm I noticed that two of the peals began with a musical note of distinct and definite pitch. The "musical" portion of the peal lasted for about two seconds in each case, and the frequency of the note was both times about 400 per second.

This sound closely resembled a foot-fall in a narrow alley between high walls, and was only heard in two consecutive peals, separated by an interval of about a minute, the first being much more definitely musical than the second. In each case the interval between the flash and the first sound of thunder was about five seconds.

As is well known, a peal of thunder from lightning near at hand frequently sounds like a quick succession of raps or a volley of guns. Can the successive raps have followed one another so rapidly in this case that they combined to form a note?

If so, and if this note was due to a special configuration of reflecting surfaces in the clouds, possibly to others in slightly different positions, considerably different frequencies may have been observed.

The fact that two peals only sounded in this manner separated by the short interval of about one minute, and that the second was not so decidedly musical as the first, seems to indicate that they were due to some rapidly changing source such as one might expect the reflecting surfaces of a cloud to be. I listened carefully to deter-

mine that the note had its origin outside and was not due to resonance within the room, and in the second peal it was certainly outside, and probably had the first had its origin within the room I should have observed it.

I should be very glad, to hear if anyone has observed a similar phenomenon.

G. H. MARTYN.
1 Marden Road, S. Tottenham, N., June 24.

How do Inquiline Bees find the Nest of their Host?

THE following observation may serve to throw light on the above question, which has doubtless occurred to many entomologists. Yesterday I saw a specimen of the inquiline *Coelioxys quadridentata* enter the burrow of a leaf-cutter bee, *Megachile circumcincta*. I dug the nest out of the burrow, and in so doing scattered the sand over an area of several square inches, completely destroying all appearance of a burrow. I sat down to await the return of the *Megachile*, in order to identify the species, and was much astonished to see (and capture) in the course of the next ten minutes two more specimens of *Coelioxys*, which came hovering over the spot and alighted on the disturbed soil. I can think of no other explanation than that these "cuckoos" were attracted to the spot by the scent of the excavated nest. I may add that during several hours spent on the heath where this occurred I saw no other specimens of *Coelioxys*, and, further, that there was a fresh south-east breeze blowing at the time, and that the bees came up against the wind.

OSWALD H. LATTER.

Charterhouse, Godalming, June 24.

THE DISTURBANCE OF GREENWICH OBSERVATIONS.

IN the House of Lords on Thursday last, June 21, attention was directed to the threatened danger to the continued efficiency of the Royal Observatory, Greenwich, caused by the great electrical generating station erected by the London County Council about half a mile due north of the observatory. The danger was referred to by the Astronomer Royal in his report to the Board of Visitors on May 30, a summary of which appeared in NATURE of June 7 (p. 135). The generating station is situated exactly in the Greenwich meridian, as will be seen from the accompanying photograph of a view looking north over the top of the transit room; and the tall chimneys shown in the picture, as well as the heated air from them, will obviously interfere with some observations of northern stars, which are essential for latitude and refraction. Moreover, from tests already made it appears that the powerful engines which are being installed at the generating station will cause vibrations that will seriously affect the value of observations by reflection from a mercury horizon, required for the fundamental work of the observatory.

This is not the first time that the effects of generating stations and electric tramway systems in the neighbourhood of the observatory have been pointed out. About six years ago the question of the possible effect of disturbances from electric railways on the magnetic work carried on at the observatory was given careful consideration; and the hope was then expressed that in the event of future electric tramways regulations would be laid down by the Board of Trade to secure adequate protection for the magnetic work. The records in this department of the observatory have been obtained continuously on a general system for sixty-five years, but the astronomical work extends over more than two centuries and a quarter, and it would be unfortunate if circumstances should arise to break this chain of continuity.

The generating station established at Deptford - nearly a mile from the observatory—to supply the London County Council Tramways with electric

power, has not caused such serious tremors as are produced by the small portion of the engineering plant now available for work at the new station, which is much nearer and larger. It appears, therefore, that if the new station is completed and equipped to supply electric power over London, though it was authorised only for the requirements of tramways, the work of the observatory will be impaired to no slight extent. When the scheme was first put forward, it was not supposed that the works or the engines would assume the gigantic and overpowering proportions now contemplated, and the Astronomer Royal, in referring to this point in his report, remarks :—

The question arises why the immediate neighbourhood of the observatory should be selected for the planting of generating stations on an unprecedented scale to supply electric power to distant districts. The very powerful engines required for such a large output are liable to cause

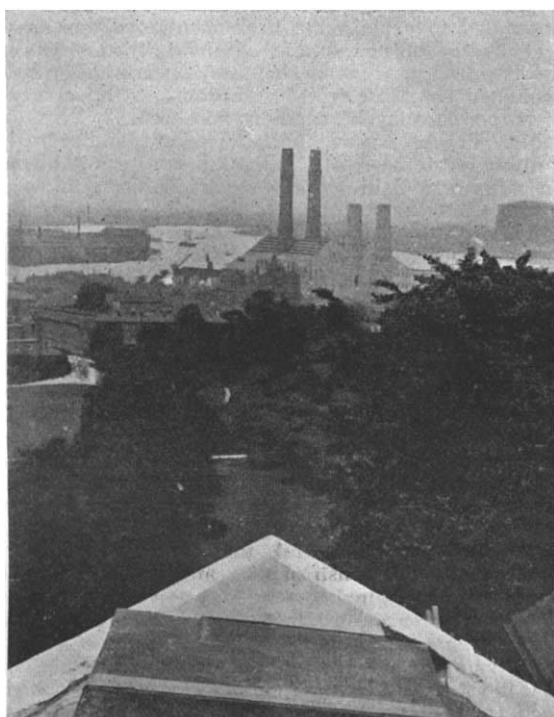


FIG. 1.—View of chimneys of the electrical works of the London County Council, looking north over the transit room of the Royal Observatory, Greenwich. The roof of the transit room is shown at the bottom of the picture.

vibrations the extent of which could hardly be anticipated from previous experience of ordinary engineering plant or of railway trains, which have hitherto not affected the work of the observatory.

The question as to the action the Government proposes to take to prevent the Royal Observatory from being injuriously affected by electric stations or other works, either at present or in the future, was asked in the House of Lords by Lord Ellenborough, who remarked that the difficulty which has arisen might have been obviated to some extent by the installation of turbines or triple-expansion horizontal engines instead of vertical engines. The Earl of Crawford pointed out that the interference with observations would arise from the heated air of the chimneys and the tremors due to machinery in motion. He said in the course of his remarks :—

The essentials for observation of an astronomical kind are stability and quietude. Nothing is so dangerous in astronomical observation as the unknown errors which have to be guarded against at the present time. If an error is known no great harm is done. In connection with the meridian, careful observations of the moon require to be made. For very many years the moon has been given over by the scientific world to Greenwich Observatory. The Royal Observatory has specialised on the moon mainly owing to the grand labours of Sir George Airy, the late Astronomer Royal, so that the position of the moon at a given time hence may be fairly accurately predicted. The observations at Greenwich, and the manner in which they have been carried out by the late Astronomer Royal, have led the whole scientific world to say, "Gentlemen, you know your moon so well, pray continue to be responsible for her." If now Greenwich is reduced to the position of saying that its lunar observations have not the weight and value which so far have attached to them, it will be a terrible blow to the reputation of the Royal Observatory and also to our existence as a scientific country. Another difficulty is that disputes as to boundaries between countries are mainly settled by astronomical observation as to the position of the moon, and as the moon is being constantly watched at Greenwich Observatory, applications are frequently received from foreign countries as to the error of the moon at such an hour on such a day. This also shows how extremely important it is that the observations at Greenwich should be trustworthy.

The suggestion that the observatory should be moved from Greenwich was considered by Lord Kelvin to be a most undesirable solution of the difficulty. He added :—

Even at present we may look forward to possible changes in the arrangement of the works by which the electricity will not seriously disturb or practically cripple the astronomical observations at Greenwich. The disturbance caused at the observatory by the vibration from the electric works may be to some extent avoided by the substitution of steam turbines for reciprocating engines and the use of different electric dynamos. It is no exaggeration to say that the whole world outside, as well as the British Empire, would deplore anything that would injure the great and good work done in the Royal Observatory at Greenwich, and both Houses of Parliament should unite in preserving it.

As further development of the machinery equipment must increase the effects shown by the tests already made, Earl Cawdor considered that powers should be obtained, or set in action, to prevent the County Council from carrying out works that injure the observatory, and that the half a million pounds expended by the Council is a small sum compared with the matter at stake.

Replying on behalf of the Government, Lord Tweedmouth, First Lord of the Admiralty, made the following statement of the case; and his remarks, with those contained in the recent report of the Astronomer Royal to the Board of Visitors, are the only official comments available upon the subject :—

Since the subject was raised it has been closely considered at the Admiralty. As to the origin of this generating station, in 1901 the London County Council resolved on it, and in 1902 a Bill was passed through Parliament. In this Bill was inserted a clause, known as the Observatory clause, which gave to the Board of Trade the power, if any use of electrical power was likely to affect injuriously the instruments used in the observatory, to require reasonable and proper precautions to be taken. This proposal was made public and approved by Parliament. It is a pity that the County Council did not more closely apprehend the possibility of danger in choosing this particular site, but some responsibility must also be attached to the various departments and to Parliament. At present, at any rate, no absolute damage has been done, but there is an apprehension of it when the station

is developed to its fullest power. It will be almost the biggest generating station in the world when completed. Eight engines will work up to 52,000 horse-power, and the electricity generated will be sufficient to work the whole of the London tramway system. At the present time the Astronomer Royal said that no serious effect has as yet arisen in the working of the principal meridian instrument. The Astronomer Royal, however, says that the instrument which has been affected is the portable transit instrument used for determining longitude. From the large generating station at Deptford no damage has resulted, and there is no indication of any disturbance. What the authorities have to do is to take very careful observation as to what is exactly going on at Greenwich. At present the station is never worked up to more than 3000 horse-power. A trial has been made of two engines, but the experiments are neither complete nor satisfactory. It is proposed to ask Prof. Ewing to represent the Admiralty in the observations to be taken, which must extend over a considerable time. The disturbances vary very much, and there is a great deal to be said as to the possibility of meeting the difficulties by reducing the high chimneys, though the Astronomer Royal does not think that the vapour of the chimneys seriously interferes with the observations. It is proposed also to ask the County Council to appoint a representative of its own for observation in order to have an independent report as to the exact amount of disturbance that might arise. The London County Council will not go on with the two chimneys, which are now only partly erected. Before doing anything it is necessary to discover whether by any re-arrangement of the machinery the threatened damage can be averted. Every effort will be made to make the inquiry a thorough one, and one which should command everyone's respect.

The position then, as stated by Viscount Goschen, is that a mistake has been made—a mistake by the Admiralty, by the Astronomer Royal, by the County Council, and by Parliament. The matter affects, not only the Royal Observatory, but the whole world; and the best scientific knowledge available should be utilised to avert any danger which imperils the useful existence of the observatory or interferes with its work.

THE SEA-SERPENT.

THE narrative of an encounter with the "sea-serpent" on December last off the coast of Para, given by Messrs. Nicoll and Meade-Waldo at the meeting of the Zoological Society held on June 19, has once more awakened interest in the question as to the possibility of the existence of a large unknown marine vertebrate animal. The appearance of the so-called "sea-serpent" has been recorded from time to time by quite a number of witnesses. Many of these alleged appearances were evidently based on objects other than vertebrate animals unknown to science, but others, as being witnessed by trustworthy and educated observers, are evidently worthy of more serious consideration. The importance of the recent case—of which more anon—is that it was witnessed by two gentlemen who have undergone a long training in the observation of animals, and are therefore far less likely to be mistaken than persons who have not specially devoted themselves to the study of natural history.

To attempt to record on the present occasion all the trustworthy cases of the alleged appearance of the sea-serpent (for the sake of convenience we may discard the inverted commas) would much exceed our limits of space, and we may therefore refer our readers to the volume by Mr. A. C. Oudemans entitled the "Great Sea Serpent," published in 1892, where all the more important ones up to that date will be found mentioned. It may be profitable to

refer, however, to a few of the published opinions of naturalists on the sea-serpent question. In his *Challenger* book, the late Prof. H. N. Moseley wrote as follows:—

"The sea-serpent, however, is always open to criticism. This wonderful animal has hardly ever been seen alike by any two observers. It is nearly always easy to a naturalist to understand the stories told. Sometimes it is a pair of whales that is seen; sometimes a long mass of floating seaweed deceives the distant observer; sometimes the serpent has large eyes and a crest behind the head; then it is a ribbon-fish. I myself am one of the few professed naturalists who have seen the serpent. It was on a voyage to Rotterdam from the Thames. . . . It was a flock of cormorants, which were flying in line behind the waves, and which were viewed in the intervals between them with a sort of thaumoscopic effect."

Clearly Mr. Moseley was not "on the side of the angels"; neither was Sir Richard Owen, who attempted to explain the undermentioned appearance seen by the officers of the *Dædalus* by the seaweed theory; and that some of the appearances can be explained by Moseley's suggestions, or by a school of porpoises, may be candidly admitted.

Mr. F. A. Lucas, on the other hand, in his "Animals of the Past," although confessing himself an "agnostic" in regard to this subject, takes up a somewhat less uncompromisingly hostile attitude.

"Like the 'fossil man,'" he writes, "the sea-serpent flourishes perennially in the newspapers, and despite the fact that he is now mainly regarded as a joke, there have been many attempts to rehabilitate this mythical monster and place him on a foundation of firm fact. The most earnest of these was that of M. Oudemans, who expressed his belief in the existence of some rare and huge seal-like creature whose occasional appearance gave rise to the reports of the sea-serpent. Among other possibilities it has been suggested that some animal believed to be extinct had really lived to the present day. Now there are a few waifs, spared from the wrecks of ancient faunas, stranded on the shores of the present, such as the Australian *ceratodus* and the gar-pikes of North America. . . . If a fish of such ancient lineage as the gar-pike is so common, why may there not be a few plesiosaurs or a mosasaur in the depths of the ocean? The argument was a good one, the more that we may 'suppose' almost anything; but it must be said that no trace of any of these creatures has so far been found outside of the strata in which they have long been known to occur, and all the probabilities are opposed to this theory."

The event recorded by Messrs. Nicoll and Meade-Waldo took place in the forenoon of December 7, 1905, when they were on board the yacht *Valhalla* off the coast of Para. At a distance of about 100 yards from the vessel the two observers saw what appeared to be the vertical dorsal fin of some large animal, and a short time afterwards the head and neck of an animal was raised above the water some distance in advance of the fin. The head was compared to that of a turtle, while the neck appeared to be about 6 feet in length. The description, so far as we can judge, suggests a creature of not more than about 20 feet or 25 feet in length. Although the vessel was subsequently put about, no further signs of the sea-serpent were seen during daylight. It is, however, noteworthy that during the night two of the ship's officers became aware of the presence of some large animal swimming alongside the yacht at a rapid pace; the two officers, it is stated, had no cognisance of the events of the morning.